

## CLAIMS

What is claimed is:

1. A charged particle beam lithography system for exposing a target
- 5 comprising:
- a source of a charged particle beam;
- a first lens located coaxial to and downstream with regard to a direction of propagation of the beam from the source for directing the beam to the target;
- 10 an immersion lens located coaxial to the beam and downstream from the first lens, the immersion lens comprising:
- a deflection coil located coaxial to the beam; and
- a magnetic field shield located coaxial to the beam and downstream from the deflection coil; and
- 15 a support for the target downstream from the immersion lens, wherein the magnetic field shield is located intermediate the deflection coil and the support, thereby limiting a magnetic field generated by the deflection coil downstream from the magnetic field shield.
- 20 2. The system of Claim 1, wherein the immersion lens further comprises:
- a first pole piece located coaxial the beam to and downstream from the first lens, the first pole piece extending at least partly around the deflection coil.
- 25 3. The system of Claim 2, further comprising a non-magnetic mount that couples the magnetic field shield to the first pole piece.
4. The system of Claim 2, wherein the immersion lens further comprises an excitation coil located coaxial to the first pole piece.

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5. The system of Claim 4, wherein the immersion lens further comprises a second pole piece located coaxial to the excitation coil.

6. The system of Claim 5, further comprising a non-magnetic spacer located

5 coaxial to the beam, the spacer being intermediate the first pole piece and the second pole piece.

7. The system of Claim 5, wherein the first pole piece and the second pole piece are spaced apart.

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8. The system of Claim 1, wherein the magnetic field shield is located such that its upper surface is at least approximately parallel to a magnetic equipotential surface of a focusing magnetic field within the immersion lens.

15 9. The system of Claim 1, wherein the magnetic field shield is of ferrite.

10. The system of Claim 1, wherein the magnetic field shield is a disk defining a central bore for passage of the beam.

20 11. The system of Claim 10, wherein the central bore has a radius  $r$  and is located approximately a distance  $2r$  above an upper surface of a target.

12. The system of Claim 1, wherein the magnetic field shield is a cone defining a central bore for passage of the beam.

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13. The system of Claim 12, wherein the central bore has a radius  $r$  and the central bore of the cone is located approximately a distance  $2r$  from an upper surface of a target.

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14. The system of Claim 12, wherein the cone has an outer radius of  $R$  and a height  $H$  such that its upper surface is at least approximately parallel to a magnetic equipotential surface of a focusing magnetic field within the immersion lens.

5 15. The system of Claim 1, further comprising a detector located intermediate the magnetic field shield and the support for the target.

16. The system of Claim 1, wherein the support is of non-magnetic and at least partially electrically insulating material.

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17. An immersion lens assembly for use with a charged particle beam comprising:

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a deflection coil located coaxial to the beam;

an excitation coil located coaxial to the deflection coil;

a first pole piece located coaxial to the excitation coil, the first pole piece extending at least partly around the excitation coil;

a magnetic field shield located coaxial to and downstream with regard to propagation of the beam from the deflection coil;

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a support for a target of the charged particle beam and downstream with regard to propagation of the beam from the ferrite shield, wherein the magnetic field shield is located intermediate the deflection coil and the support, thereby limiting a magnetic field generated by the deflection coil from radiating downstream from the magnetic field shield.

25 18. The immersion lens assembly of Claim 17, wherein the first pole piece is of iron.

19. The immersion lens assembly of Claim 17, further comprising a second pole piece located coaxial to the deflection coil, the second pole piece extending at least partly around the deflection coil.

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20. The immersion lens assembly of Claim 19, wherein the second pole piece is of ferrite.

5 21. The immersion lens assembly of Claim 17, wherein the magnetic field shield is located such that its upper surface is at least approximately parallel to a magnetic equipotential surface of a magnetic field generated by the excitation coil.

10 22. The immersion lens assembly of Claim 17, wherein the magnetic field shield is of ferrite.

23. The immersion lens assembly of Claim 17, further comprising a detector located intermediate the magnetic field shield and the support for the target.

15 24. The immersion lens assembly of Claim 17, wherein the support for the target is of non-magnetic and electrically conductive material.

20 25. A method for exposing a target comprising the acts of:  
generating a charged particle beam;  
directing the charged particle beam towards the target;  
generating a first magnetic field for immersing the target in an approximately uniform magnetic field;  
generating a second magnetic field for deflecting the magnetic axis of the first magnetic field; and  
25 at least partially shielding the second magnetic field from a region including the target.

30 26. The method of Claim 25, further comprising the acts of:  
locating a magnetic equipotential surface of the second magnetic field; and

wherein the act of shielding includes mounting a magnetic field shield so that its upper surface is at least approximately parallel to the magnetic equipotential surface.

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- 5 27. The method of Claim 26, wherein the shield is of ferrite.
28. The method of Claim 25, wherein the act of shielding comprises defining a planar shaped limit.
- 10 29. The method of Claim 25, wherein the act of shielding comprises defining a conical shaped limit.
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